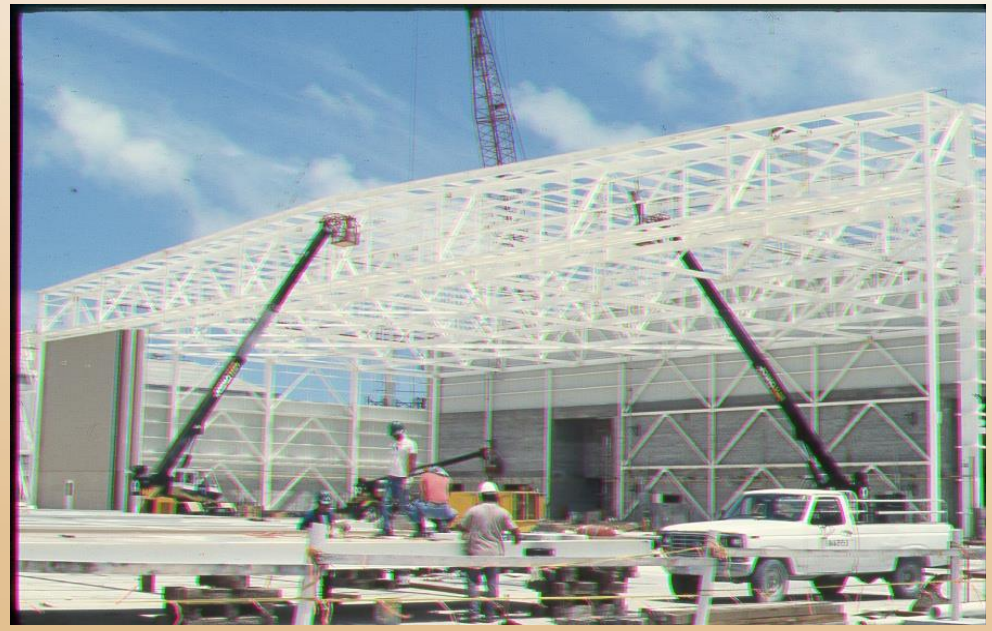
Defense Acquisition University

Scheduling Network and Anaylsis



Lesson 4
FE 302

Introduction

Terminal Learning Objectives

- Create a detailed integrated master schedule

Enabling Learning Objectives

- Build a construction schedule using the Critical Path Method (CPM)
- Analyze a baseline construction schedule for reasonableness
- Determine how changed conditions can affect the overall construction schedule

Schedules

Policy: Fixed price contract, over SAT, with a 60-day or more duration.

- **Within a time period required by KO, the KTR must submit a practicable schedule for approval to the KO**
  - **Reasonable = length of tasks**
  - **Feasible = Order of tasks**
  - **Obtainable = Total duration**
- **Dates for starting and completing salient features of work (acquiring materials, plant and equipment)**
- **Progress chart of suitable scale to:**
  - **Indicate % of work scheduled for completion**
  - **By any given date during the contract**

Schedules

- **Purpose**
  - **Provides GOV with tool to measure progress**
  - **Remedies available if KTR falls behind schedule**
- **Case Law supports that the approved schedule becomes part of the written record**
- **Question: What if a contractor submits a schedule with early completion?**

Schedules Continued…

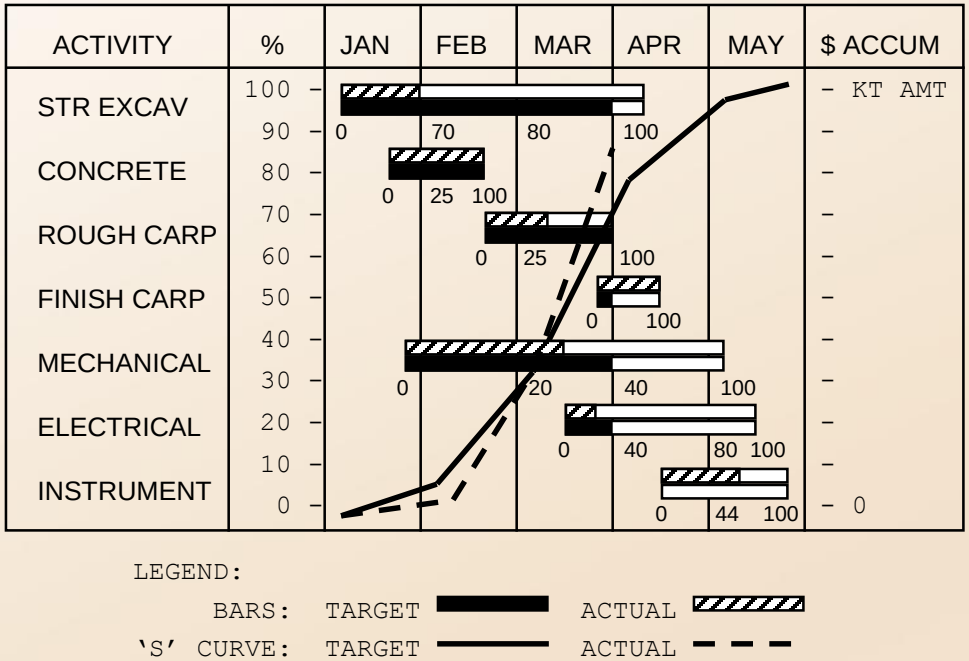
Two Types

- *Bar Chart* **UFGS 01 32 01.00**
- Critical Path Method *(CPM)* **or Network Analysis Schedule NAS) UFGS 01 32 17.00**

Factors to Consider

- **Complexity of Project**
- **Criticality of Completion**
- **Coordination with Other Contracts**
- **Contractor's Expertise**
- **Cost Benefit Ratio of Requiring Detailed Schedule**

Bar Chart



Advantages:

- Simple to use
- Inexpensive
- Easy to understand (Less complex projects)
- Able to show limited task interdependency

Critical Path Method (CPM)

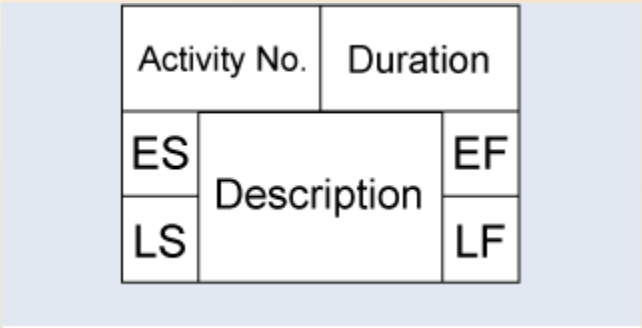
- Used on complex projects, where the relationship and interdependency of the individual construction activities
- Every CPM schedule will have at least one path through the network, which controls the overall project duration

Critical Path Method (CPM)

- This path represents the route of longest combined duration through the diagram
- The route is referred to as the "critical path," since any delay in a construction activity on the path will result in an increase of the project's overall duration
- For those activities not on the critical path, there exists some amount of flexibility as to when each one can start or finish without affecting the overall project duration. This flexibility is known as “float”, and can be calculated for each activity

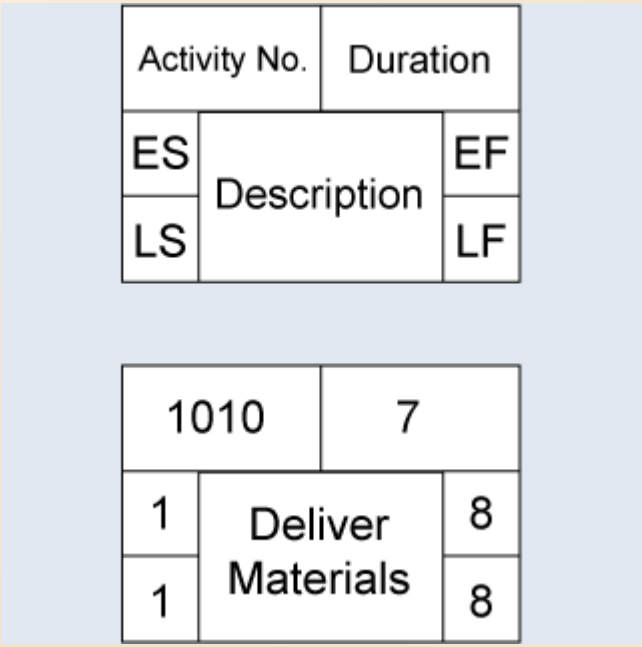
Critical Path Method (CPM)

Principle One:
Activities shown in boxes (node)



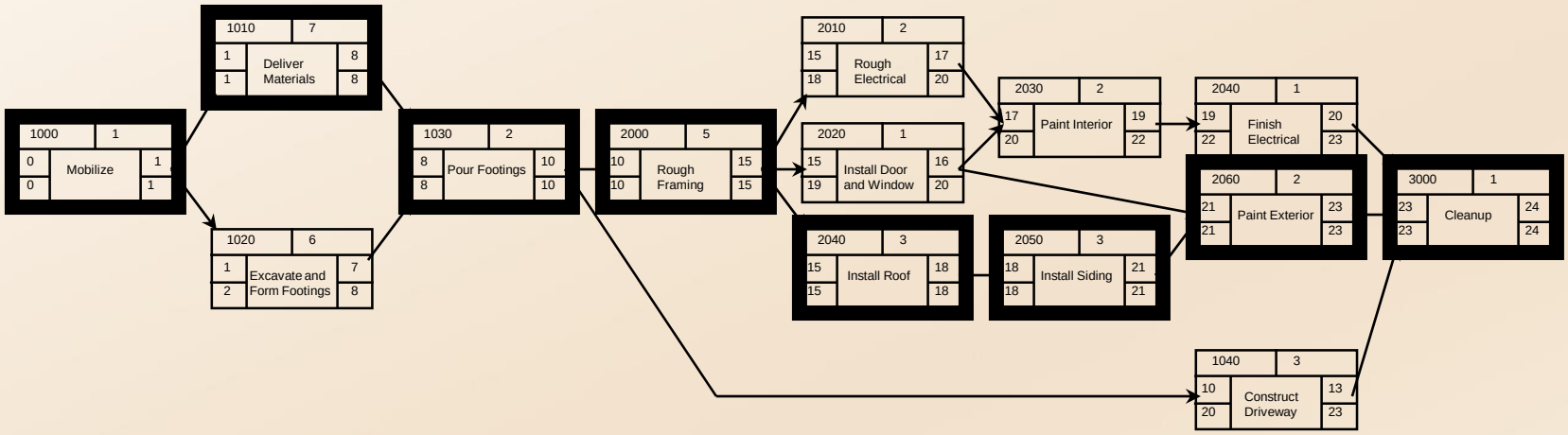
Critical Path Method (CPM)

Principle Two:
All future activity depends on completion of all preceding activities



Critical Path Method (CPM)

Principle three:
All activities begin and end at a describable point in time



CPM Network Calculations

CPM provides the ability to determine:

- Earliest date of project completion
- Latest date of project completion if there are no changes
- Impact on the project completion date of delaying a specific activity
- Critical activities for completing the project on or before the completion date

CPM Network Calculations

Process:

- Perform a Forward Pass
- Perform a Backward Pass
- Calculate Total Float for each activity
- Calculate Free Float
- Identify the Critical Path

Forward Pass

Forward Pass (beginning to end; L=>R)

- Determines duration of project
- Start time of the project is Day Zero (0)
- Early Finish time of each task is its Early Start time plus its estimated duration
- Early Start time of tasks is the Early Finish of the immediate preceding task
- Events having more then one predecessor task occur when ALL predecessor dependencies have been met

Forward Pass

Early Finish = Early Start + Duration

- **EF = ES + DUR**

Backward Pass

Backward Pass (end to beginning; R=>L)

- Determines critical path & float activities
- Project Late Finish time is taken from the Forward Pass calculation of the project Early Finish time
- Task Late Start time is calculated by subtracting estimated task duration from Late Finish time
- The Late Finish time of each predecessor task is the Late Start of its immediate successor task
- Activities having more than one successor task must occur soon enough to meet all successor dependencies by Project Late Finish time.

Backward Pass

Late Start = Late Finish - Duration

- **LS = LF - DUR**

Float

Float (or slack) is the amount of time that an individual schedule activity can be delayed without delaying the project finish date

- FLOAT = Late Finish – Early Finish

Float

Total Float = Late Start - Early Start

- TF = LS - ES

Free Float = Early Start (Next Activity) - Early Finish

- FF(x) = ES(x+1) - EF(x)

The Critical Path

The Critical Path:

- Identifying the Critical Path
  - The series of schedule activities that determines the duration of the project
  - Generally, the longest path through the project
  - Usually defined by the schedule activities with zero float (critical path activities)

Actions to Shorten the Critical Path

Schedule Compression Techniques

- Fast Tracking
  - Planning and/or overlapping sequential activities to be performed in parallel
- Crashing
  - Analyzing cost and schedule trade-offs to achieve reductions in schedule activity durations
  - Generally requires additional resources and person-hours
  - Increases costs
  - Must produce a shorter critical path to be visible (non-critical path activities can be crashed, but may not provide an overall benefit).

CPM Advantages

Advantages: (complex projects)

- Accepted as evidence in court
- Shows high degree of task interdependence
- Shows cause & effect, impact & delay
- Separate float time and critical activities

Schedule Initial Reviews

- **Factors to Consider**
  - Total duration conforms to contract duration
  - Identifies critical activities for contractor and government
  - Reasonable duration of specific activities and sequence “logic”
  - Sufficiently demonstrate activity relationships to support delay analysis
  - Permit adequate detail to allow for progress review and payments